WIND INPUT, SURFACE DISSIPATION AND DIRECTIONAL PROPERTIES OF SHOALING WAVES

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LONG-TERM GOAL

The long-term goal of this project, which is a component of the "Shoaling Waves DRI", is to better understand the energetics of shoaling surface gravity waves, and to use this new knowledge to improve predictive models of wave evolution in the coastal environment.

OBJECTIVES

Models typically describe the evolution of the wavenumber spectrum of the wave field as a function of fetch and duration. The rate of spectral change in each wavenumber band is given by the mismatch between several "source" terms that describe the rates of [1] energy input from the wind, [2] transfer of energy into or out of the band due to nonlinear interaction with other wave components, and [3] energy dissipation (both due to wave breaking and to the drag exerted by the bottom).

APPROACH

Measurements of wave height and direction, as well as the meteorological forcing, and near-surface turbulence dissipation rates (which are related to wave dissipation via breaking) will be obtained from an array of three ASIS (Air-Sea Interaction Spar) buoys, and a SWATH (Small Waterplane Area Twin Hull) ship. Other components of the DRI will provide estimates of bottom friction. These data will be used to establish the evolution of the wave field from the shelf break into the nearshore region, and to estimate the various source terms described above.

This grant is closely coupled to work being carried out under the DRI by the University of Miami (M.A. Donelan and H.C. Graber, PIs). We are responsible for constructing two additional ASIS buoys, for the water-side turbulence measurements to be conducted from both the buoys and SWATH, and for part of the ADCP current profiling.

WORK COMPLETED

We further studied the response of the ASIS buoy based on data acquired from a deployment in the Gulf of Mexico earlier this year. The results of this analysis lead to several changes in the buoy design.
Two additional buoys incorporating our design changes will be fabricated later this year (1997).

We also investigated the use of conventional upward-looking ADCPs (Acoustic Doppler Current Profilers) to measure wave height and direction as well as current. The success of this approach will increase the number of fixed locations from which we can acquire wave measurements in the field.

RESULTS

The work described above has lead to two main results:

[1] We now have a robust characterization of the ASIS response function. This is useful both in the design stage, and during data analysis.

[2] We have shown that conventional ADCPs have promise for measuring waves. Preliminary results were reported at the Oceans'97 conference, and appear in the published proceedings.

RELATED PROJECTS

Although we are collaborating with all of the other components of the ONR Shoaling Waves Program, this grant is very closely coupled to a grant of the same title from the University of Miami that is being directed by M.A. Donelan and H.C. Graber.

REFERENCES

H.C. Graber, 1997: FY97 ONR Annual Report.

Terray, Eugene, R. Lee Gordon and Blair Brumley, 1997: Measuring Wave Height and Direction Using Upward-Looking ADCPs. Oceans'97 MTS/IEEE Proceedings, pp. 287-290, IEEE Press.